



**Cambridge Assessment International Education**  
Cambridge International General Certificate of Secondary Education

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**COMBINED SCIENCE**

**0653/61**

Paper 6 Alternative to Practical

**May/June 2018**

MARK SCHEME

Maximum Mark: 60

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**Published**

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**GENERIC MARKING PRINCIPLE 2:**

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**GENERIC MARKING PRINCIPLE 6:**

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| Question | Answer                                                                                                                                                                                                                                                                                                                                         | Marks    |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 1(a)(i)  | axes labelled with units ;<br>at least 6 points plotted correctly $\pm$ half small square ;                                                                                                                                                                                                                                                    | <b>2</b> |
| 1(a)(ii) | smooth curve ;                                                                                                                                                                                                                                                                                                                                 | <b>1</b> |
| 1(b)(i)  | correct reading from graph and shown on graph $\pm$ half small square ;                                                                                                                                                                                                                                                                        | <b>1</b> |
| 1(b)(ii) | decreases ;                                                                                                                                                                                                                                                                                                                                    | <b>1</b> |
| 1(c)     | gloves because enzyme present /<br>goggles to protect eyes from splashes ;                                                                                                                                                                                                                                                                     | <b>1</b> |
| 1(d)     | any <b>four</b> from:<br>same volume / concentration of peroxide / solution ;<br>same volume of bean puree / same batch of puree ;<br>same time / same height ;<br>minimum of 5 different temperatures ;<br>sensible range of temperatures ;<br>graph of volume against time for each temperature / volume in fixed time against temperature ; | <b>4</b> |

| Question  | Answer                                                                                             | Marks    |
|-----------|----------------------------------------------------------------------------------------------------|----------|
| 2(a)(i)   | <b>H AND</b> white ppt. (with silver nitrate) /<br><b>H AND</b> (white) ppt dissolves in ammonia ; | <b>1</b> |
| 2(a)(ii)  | yes <b>AND</b> different coloured ppts. ;                                                          | <b>1</b> |
| 2(a)(iii) | no need to eliminate carbonate / cannot be a carbonate / already know solutions are halides ;      | <b>1</b> |
| 2(b)(i)   | <b>J and K</b><br><b>AND</b><br>reference to possible bromine colour ;                             | <b>1</b> |
| 2(b)(ii)  | ventilated lab / fume cupboard ;                                                                   | <b>1</b> |
| 2(b)(iii) | add bromine water ;<br>iodide will go darker / orange ;<br>OR<br>add starch ;<br>blue-black ;      | <b>2</b> |
| 2(c)(i)   | burette / (graduated) pipette ;                                                                    | <b>1</b> |
| 2(c)(ii)  | indicator would be an impurity ;                                                                   | <b>1</b> |
| 2(c)(iii) | repeat (with indicator and take average volume) ;                                                  | <b>1</b> |

| Question  | Answer                                                                                                              | Marks    |
|-----------|---------------------------------------------------------------------------------------------------------------------|----------|
| 3(a)(i)   | $l_0 = 28 \pm 1$ ;                                                                                                  | <b>1</b> |
| 3(a)(ii)  | view perpendicular to scale / ruler close to spring / use of fiducial aid ;                                         | <b>1</b> |
| 3(b)      | subtraction of two lengths ;<br>39 (mm) ;                                                                           | <b>2</b> |
| 3(c)(i)   | suitable choice of scales and linear ( $\geq$ half the grid used) ;<br><br>4 plots correct to half a small square ; | <b>2</b> |
| 3(c)(ii)  | good best fit line judgement ;                                                                                      | <b>1</b> |
| 3(c)(iii) | correct intercept read from / axis $\pm 1$ mm and evidence from graph ;                                             | <b>1</b> |
| 3(d)      | expect Yes – answers the same / close enough / within 10% / 15% / within experimental error ;                       | <b>1</b> |
| 3(e)      | steeper gradient graph ;                                                                                            | <b>1</b> |

| Question  | Answer                                                                                                                                | Marks    |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------|----------|
| 4(a)(i)   | clear outline of cell (not feathery) ;<br>approximately the correct shape and nucleus ;<br>larger than original <b>AND</b> one cell ; | <b>3</b> |
| 4(a)(ii)  | nucleus correctly labelled ;                                                                                                          | <b>1</b> |
| 4(b)(i)   | $51 \pm 2$ ;                                                                                                                          | <b>1</b> |
| 4(b)(ii)  | Drawn line and measure length ;                                                                                                       | <b>1</b> |
| 4(b)(iii) | correct calculation of magnification ;                                                                                                | <b>1</b> |
| 4(c)      | add alcohol ;<br>pour into water ;<br>white emulsion ;                                                                                | <b>3</b> |

| Question | Answer                                                                                                                                                                           | Marks    |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 5(a)     | A D B E ;;;<br><b>OR</b><br>A above D ;<br>D above B ;<br>B above E ;                                                                                                            | <b>3</b> |
| 5(b)     | Green powder in beaker / powder seen / solid in beaker / no more bubbles / gas ;                                                                                                 | <b>1</b> |
| 5(c)     | filter funnel and filter paper and v shown in filter paper ;<br>filter paper or funnel labelled AND copper carbonate / residue labelled AND copper sulfate / filtrate labelled ; | <b>2</b> |
| 5(d)(i)  | to react all of the acid / make sure crystals are pure ;                                                                                                                         | <b>1</b> |
| 5(d)(ii) | to obtain (large) crystals ;                                                                                                                                                     | <b>1</b> |
| 5(e)     | (pale) blue ppt ;<br>deep blue solution ;                                                                                                                                        | <b>2</b> |

| Question  | Answer                                                                                                | Marks    |
|-----------|-------------------------------------------------------------------------------------------------------|----------|
| 6(a)      | correct symbol for ammeter and voltmeter ;<br>ammeter in series and voltmeter in parallel correctly ; | <b>2</b> |
| 6(b)(i)   | 0.12 (A) ;<br>2.8 (V) ;<br>12 ONLY(s) ;                                                               | <b>3</b> |
| 6(b)(ii)  | 4.0 ;                                                                                                 | <b>1</b> |
| 6(b)(iii) | 0.56 ;                                                                                                | <b>1</b> |
| 6(b)(iv)  | 14 % $\text{iii} \div \text{ii}$ ;                                                                    | <b>1</b> |
| 6(c)      | Energy loss due to resistance (this is the largest) / heat / sound ;                                  | <b>1</b> |
| 6(d)      | do more circuits and average / repeat and average ;                                                   | <b>1</b> |



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| Question  | Answer                                                                                                              | Marks    |
|-----------|---------------------------------------------------------------------------------------------------------------------|----------|
| 1(a)(i)   | quality drawing and at least half the box ;<br>some detail in the centre ;                                          | <b>2</b> |
| 1(a)(ii)  | $41 \pm 1$ ;<br>line <b>and</b> measured to nearest mm $\pm 3$ ;                                                    | <b>2</b> |
| 1(a)(iii) | correct calculation of magnification ;                                                                              | <b>1</b> |
| 1(b)      | no protein ;                                                                                                        | <b>1</b> |
| 1(c)(i)   | heat (with benedict's solution) ;<br>reducing sugar present ;<br>yellow / green / orange / red ;                    | <b>3</b> |
| 1(c)(ii)  | goggles because of hot water / chemicals in eye ;<br><b>OR</b><br>use of hot water bath so hot liquid not ejected ; | <b>1</b> |

| Question                                                     | Answer                                                                                                                                                                                                                                                                                                                                                                                                                         | Marks                                           |                      |                                                 |                                   |                            |                                         |                                                              |                             |                 |          |
|--------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|----------------------|-------------------------------------------------|-----------------------------------|----------------------------|-----------------------------------------|--------------------------------------------------------------|-----------------------------|-----------------|----------|
| 2(a)(i)                                                      | ammonia solution / sodium hydroxide solution ;<br>(pale) blue ppt. ;                                                                                                                                                                                                                                                                                                                                                           | <b>2</b>                                        |                      |                                                 |                                   |                            |                                         |                                                              |                             |                 |          |
| 2(a)(ii)                                                     | <table border="1"> <tr> <td>test</td><td>observation with HCl</td><td>observation with H<sub>2</sub>SO<sub>4</sub></td></tr> <tr> <td>silver nitrate<br/><b>AND</b><br/>↓</td><td>white ppt.<br/><b>AND</b> ⇒</td><td>...no reaction / slight<br/>white ppt. ;</td></tr> <tr> <td>... barium nitrate /<br/>barium chloride / Ba<sup>2+</sup> ;</td><td>no reaction<br/><b>AND</b> ⇒</td><td>...white ppt. ;</td></tr> </table> | test                                            | observation with HCl | observation with H <sub>2</sub> SO <sub>4</sub> | silver nitrate<br><b>AND</b><br>↓ | white ppt.<br><b>AND</b> ⇒ | ...no reaction / slight<br>white ppt. ; | ... barium nitrate /<br>barium chloride / Ba <sup>2+</sup> ; | no reaction<br><b>AND</b> ⇒ | ...white ppt. ; | <b>3</b> |
| test                                                         | observation with HCl                                                                                                                                                                                                                                                                                                                                                                                                           | observation with H <sub>2</sub> SO <sub>4</sub> |                      |                                                 |                                   |                            |                                         |                                                              |                             |                 |          |
| silver nitrate<br><b>AND</b><br>↓                            | white ppt.<br><b>AND</b> ⇒                                                                                                                                                                                                                                                                                                                                                                                                     | ...no reaction / slight<br>white ppt. ;         |                      |                                                 |                                   |                            |                                         |                                                              |                             |                 |          |
| ... barium nitrate /<br>barium chloride / Ba <sup>2+</sup> ; | no reaction<br><b>AND</b> ⇒                                                                                                                                                                                                                                                                                                                                                                                                    | ...white ppt. ;                                 |                      |                                                 |                                   |                            |                                         |                                                              |                             |                 |          |
| 2(b)                                                         | filter funnel, paper and collection vessel ;<br>filtrate and residue correctly labelled ;                                                                                                                                                                                                                                                                                                                                      | <b>2</b>                                        |                      |                                                 |                                   |                            |                                         |                                                              |                             |                 |          |
| 2(c)(i)                                                      | exothermic / (metal) displacement ;                                                                                                                                                                                                                                                                                                                                                                                            | <b>1</b>                                        |                      |                                                 |                                   |                            |                                         |                                                              |                             |                 |          |
| 2(c)(ii)                                                     | copper (metal) / Cu ;                                                                                                                                                                                                                                                                                                                                                                                                          | <b>1</b>                                        |                      |                                                 |                                   |                            |                                         |                                                              |                             |                 |          |
| 2(d)                                                         | so test-tube will not crack / break ;                                                                                                                                                                                                                                                                                                                                                                                          | <b>1</b>                                        |                      |                                                 |                                   |                            |                                         |                                                              |                             |                 |          |

| Question  | Answer                                                                                                                                                               | Marks    |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 3(a)(i)   | 87.8 (cm) ;                                                                                                                                                          | <b>1</b> |
| 3(a)(ii)  | take reading each side and find average / mark the centre point on the block (edge) ;                                                                                | <b>1</b> |
| 3(b)      | $a = 30(.0)$<br><b>AND</b><br>$b = 47.8$ ;                                                                                                                           | <b>1</b> |
| 3(c)(i)   | axes labelled with units ;<br><br>suitable choice of scales ( $\geq$ half the grid used for points) ;<br><br>4 plots correct to half a small square ;                | <b>3</b> |
| 3(c)(ii)  | good best fit line judgement ;                                                                                                                                       | <b>1</b> |
| 3(c)(iii) | $6.0 \pm 1$ ;                                                                                                                                                        | <b>1</b> |
| 3(d)      | 120 ;                                                                                                                                                                | <b>1</b> |
| 3(e)      | any <b>one</b> from:<br>difficulty in obtaining balance ;<br>load <b>L</b> not uniform ;<br>difficulty in placing the centre of <b>L</b> over the mark on the rule ; | <b>1</b> |

| Question | Answer                                                                                                                          | Marks    |
|----------|---------------------------------------------------------------------------------------------------------------------------------|----------|
| 4(a)     | in the dark ;<br>for a few days / at least 24 hours ;                                                                           | <b>2</b> |
| 4(b)     | boiling water ;<br><br>(hot) alcohol ;<br><br>hot water bath ;<br><br>blue-black ;                                              | <b>4</b> |
| 4(c)     | starch masks result / to measure starch made in the leaf (in the experiment) ;                                                  | <b>1</b> |
| 4(d)     | centre of A blue-black ;<br><br>outside of A brown / orange / yellow ;<br><br>outside AND centre of B brown / orange / yellow ; | <b>3</b> |

| Question | Answer                                                                                                                          | Marks |
|----------|---------------------------------------------------------------------------------------------------------------------------------|-------|
| 5(a)     | 130.95 ;                                                                                                                        | 1     |
| 5(b)(i)  | 1.82 g ;                                                                                                                        | 1     |
| 5(b)(ii) | reagents not pure / incorrectly measured reagents ;                                                                             | 1     |
| 5(c)     | to stop acid spitting <b>out</b> ;                                                                                              | 1     |
| 5(d)(i)  | points plotted correctly ;                                                                                                      | 1     |
| 5(d)(ii) | line of best-fit ;                                                                                                              | 1     |
| 5(e)(i)  | line <b>F</b> same as gradient at start/slightly steeper <b>and</b> same starting point ;<br>line (plateauing at) 129 / 128.8 ; | 2     |
| 5(e)(ii) | line <b>M</b> steeper at start and same starting point ;<br>line stops at same value ;                                          | 2     |

| Question  | Answer                                                                                                                | Marks    |
|-----------|-----------------------------------------------------------------------------------------------------------------------|----------|
| 6(a)(i)   | 3.7 ;<br>3.2 ;                                                                                                        | <b>2</b> |
| 6(a)(ii)  | 3.5 ;                                                                                                                 | <b>1</b> |
| 6(a)(iii) | times very short / human reaction time :                                                                              | <b>1</b> |
| 6(a)(iv)  | to identify anomalies / reduce effects of errors ;                                                                    | <b>1</b> |
| 6(a)(v)   | as h increases speed increases ;                                                                                      | <b>1</b> |
| 6(b)(i)   | timer stopped late / timer started early / not timed between points P and Q ;                                         | <b>1</b> |
| 6(b)(ii)  | 1.9 ;                                                                                                                 | <b>1</b> |
| 6(c)      | any <b>two</b> from:<br>height of the ramp ;<br>size of the ball ;<br>material of the ball ;<br>surface of the ramp ; | <b>2</b> |



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| Question  | Answer                                                                                                      | Marks |
|-----------|-------------------------------------------------------------------------------------------------------------|-------|
| 1(a)(i)   | 20.5 ;<br>26.0 ;                                                                                            | 2     |
| 1(a)(ii)  | increases as temperature increases ;<br>increase in temperature increases rate of reaction/photosynthesis ; | 2     |
| 1(a)(iii) | <b>amount of</b> pondweed ;<br>more weed produces more bubbles AW ORA ;                                     | 2     |
| 1(b)      | no/fewer bubbles <b>and</b> light needed for photosynthesis ;                                               | 1     |
| 1(c)(i)   | glowing splint <b>and</b> relights ;                                                                        | 1     |
| 1(c)(ii)  | bubbles not the same size / volume / bubbles missed in counting ;                                           | 1     |
| 1(c)(iii) | measuring cylinder / burette or gas syringe <b>and</b> water in correct place ;                             | 1     |

| Question  | Answer                                                                                                                                               | Marks    |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 2(a)(i)   | conical flask connected using a bung to... ;<br>...gas syringe / inverted measuring cylinder over water ;<br>at least two correct apparatus labels ; | <b>3</b> |
| 2(a)(ii)  | no more bubbles / no more gas collected / volume reading remains the same / no solid left / no zinc left ;                                           | <b>1</b> |
| 2(b)(i)   | scales linear and using at least half of grid ;<br>at least 5 points plotted correctly $\pm \frac{1}{2}$ square (excluding (0,0) ;                   | <b>2</b> |
| 2(b)(ii)  | best-fit line ;                                                                                                                                      | <b>1</b> |
| 2(b)(iii) | volume at $t = 5$ mins read from graph $\pm \frac{1}{2}$ square<br><b>AND</b><br>lines on graph ;                                                    | <b>1</b> |
| 2(c)      | steeper line (and through origin) ;<br>plateau at $96 \text{ cm}^3$ ;                                                                                | <b>2</b> |

| Question  | Answer                                                                                                             | Marks |
|-----------|--------------------------------------------------------------------------------------------------------------------|-------|
| 3(a)(i)   | 0.18 A ;<br>1.4 V ;                                                                                                | 2     |
| 3(a)(ii)  | 0.25(2) (W) ;                                                                                                      | 1     |
| 3(a)(iii) | cell / battery will run down ;                                                                                     | 1     |
| 3(b)(i)   | 0.32 ;<br>0.29 ;                                                                                                   | 2     |
| 3(b)(ii)  | 0.61(6) (W) ;                                                                                                      | 1     |
| 3(c)      | Lamps glow dimmer in series / brighter in parallel ;                                                               | 1     |
| 3(d)      | (lamp Y) because for same p.d.;<br>current is smaller ;<br><b>OR</b><br>use $V/I$ ;<br>correct calculation shown ; | 2     |

| Question | Answer                                                                                                                                                  | Marks    |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 4(a)     | <b>deep</b> breath / breathe in <b>as much as possible</b> ;<br>breathe out <b>all</b> breath <b>AND</b> measure new volume ;                           | <b>2</b> |
| 4(b)(i)  | (sample B)<br>contains <b>more</b> carbon dioxide ;<br>produced in respiration ;<br><b>OR</b><br>contains <b>less</b> oxygen ;<br>used in respiration ; | <b>2</b> |
| 4(b)(ii) | (bubble through) limewater <b>and</b> turns milky ;                                                                                                     | <b>1</b> |
| 4(c)     | values higher for<br>rate ;<br>volume;                                                                                                                  | <b>2</b> |
| 4(d)     | find pulse over stated time ;<br>before and after exercise ;<br>repeat and average / sample size and average ;                                          | <b>3</b> |

| Question  | Answer                                                                                                            | Marks |
|-----------|-------------------------------------------------------------------------------------------------------------------|-------|
| 5(a)      | correct <i>inert electrodes</i> label line ;<br>correct <i>aqueous copper chloride</i> label line ;               | 2     |
| 5(b)(i)   | blue litmus / red litmus ;<br>goes white / bleached ;                                                             | 2     |
| 5(b)(ii)  | (pale) blue ppt. ;<br>dark blue solution ;                                                                        | 2     |
| 5(c)(i)   | 15:00 ;                                                                                                           | 1     |
| 5(c)(ii)  | 12.14 ;                                                                                                           | 1     |
| 5(c)(iii) | (total) mass is proportional to (total) time ;<br>every 300 s mass increases by 0.17 g (or equivalent argument) ; | 2     |

| Question | Answer                                                                                               | Marks |
|----------|------------------------------------------------------------------------------------------------------|-------|
| 6(a)     | voltmeter connected in parallel with heating coil ;                                                  | 1     |
| 6(b)(i)  | to ensure that all the water is at the same temperature ;                                            | 1     |
| 6(b)(ii) | heat still flowing from heater to the water ;                                                        | 1     |
| 6(c)     | 18 000 (J) ;                                                                                         | 1     |
| 6(d)     | substitution / manipulation ;<br>5.45(4545) (J/g°C) ;                                                | 2     |
| 6(e)(i)  | heat loss ;<br>taking temperature too soon (as told temperature continues to rise) ;<br>no repeats ; | 2     |
| 6(e)(ii) | insulate the sides / base / use a lid / stir for longer/ until temperature stops rising ;            | 1     |
| 6(f)     | (rate of)heat loss (from sides / base / surface) is equal to (rate of) heat gain (from heater) ;     | 1     |